

In this issue

Challenges in Geoscience

Underrated rockstar of science

The theme for this year's Earth Day is 'Restore our Earth', focusing on natural processes that drive the ecosystem. But the theme also stirs curiosity in the science of the earth: geoscience.

What are the unsolved questions and challenges of modern geoscience? Rasoul Sorkhabi created a survey for specialists from different branches of geoscience to elicit the most important questions. Now, in this issue, he reports his results.

The majority of the scientists pointed to global warming and crude oil as burning challenges. Closely followed by principles controlling tectonics and the climate. Many are also eager to unravel the origins of earth and life. There are other subplots covering other issues in a General Article on **page 1426**.

The questions raised have several possibilities and are often overlapping. Because geoscience takes elements and principles from other natural sciences. Though geoscience is important, it is not given adequate attention in basic education. Educating students and the public about the Earth will give a wider sense of science in general.

Inhibiting Nucleotide Metabolism

Disrupting supply chains in pathogens

As pathogens develop resistance to antibiotics, one has to look for new ways to disrupt their lifecycle. Understanding the energy pathways of different pathogens allows us to develop better inhibiting mechanisms.

Nucleotides are conserved metabolites in all organisms. Nucleotide synthesis, to build RNA and DNA, is regulated by many pathways – from metabolism to gene expression. Any alterations in these pathways can hinder the growth and development of all organisms. Especially, that of the pathogens.

Now, in a Review Article, Sujata Kumari and Prajna Tripathi report the metabolism of different disease-inducing pathogens. The energy-intensive process of nucleotide synthesis is regulated by molecules like purine and pyrimidine. Most pathogens pro-

duce these molecules *de novo*. They also have salvage pathways for converting available nucleosides to nucleotides.

Perturbing these pathways can selectively inhibit pathogen reproduction. The signalling molecules of such reactions are also disrupted. This is a key result: signalling molecules influence bacterial virulence and persistence as well as antibiotic resistance, thus influencing the course of many infections.

Developing drugs is an ever-evolving, dynamic field. Identifying the modulators of metabolic pathways allows precision intervention. Turn to **page 1458** of in this issue for details.

Managing COVID-19

Antiviral alternatives

In the first wave of COVID-19, the world tried repurposing non-antivirals such as hydroxychloroquine, ivermectin, nafamostat, etc. with limited success. Remdesivir, an antiviral, survived and, in the present wave of the pandemic, seems to be the favoured prescription for lack of better alternatives. But why are we not exploring other available antivirals?

Scientists from Central, State and private institutions collaborated to investigate, using molecular simulations and docking studies. They chose 61 comparatively safer antivirals that are already approved for clinical use. They selected three target points to attack SARS-CoV-2: entry, replication and maturation.

Remdesivir, a nucleotide analogue, interferes with viral replication. But it binds with the pocket of spike protein-human cell interaction, the entry point, and the viral protease required for maturation also. The researchers compared the other antivirals against this standard. There were twelve antivirals with comparable combined activity. The researchers short listed five among them based on pharmacokinetic and pharmacodynamic parameters. Further considerations on safety profile as well as oral administration (as against Remdesivir which is injectable) highlighted the potential of using ledipasvir and daclatasvir against SARS-CoV-2.

Initial clinical trials using a combination of daclatasvir and ledipasvir against SARS-CoV-2 have already shown promising results, point out the authors in a Research Article in this issue. They recommend further clinical evaluation of these already approved drugs for COVID-19 treatment. Turn to **page 1464** for hope, combined with reason.

Uranium in Drinking Water

Surveying the sources

Uranium, especially the isotope of atomic weight 235, is of strategic importance as a fissile material for the production of nuclear energy. But, out of the uranium available on Earth, this isotope constitutes only about 0.7%. Its cousin, uranium with atomic weight 238, too, is important: it can be converted to fissile material using neutrons. More than 99% of uranium one is composed of this isotope. And uranium 234, the other naturally occurring isotope, is usually only found in meagre amounts. All three isotopes show radioactivity.

Under oxygenating conditions, uranium dissolves easily in water. So it is found in groundwater as well as in surface water. Scientists from the Bhabha Atomic Research Centre recently undertook a survey of uranium in drinking waters sources in India. To undertake this mammoth task, they involved a large number of educational and research institutions to collect 55000 samples from groundwater and about 1000 surface water samples from sources used for drinking. Besides uranium isotope concentrations, they measured 12 other water quality parameters.

While presenting the results in a Research Article in this issue, the researchers point out the lack of consensus on the safe limits permitted for uranium in drinking water. The data collected will facilitate studies in this direction, they say. Read on from **page 1482**.

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